

(19) World Intellectual Property  
Organization  
International Bureau



01 APR 2005



(43) International Publication Date  
15 April 2004 (15.04.2004)

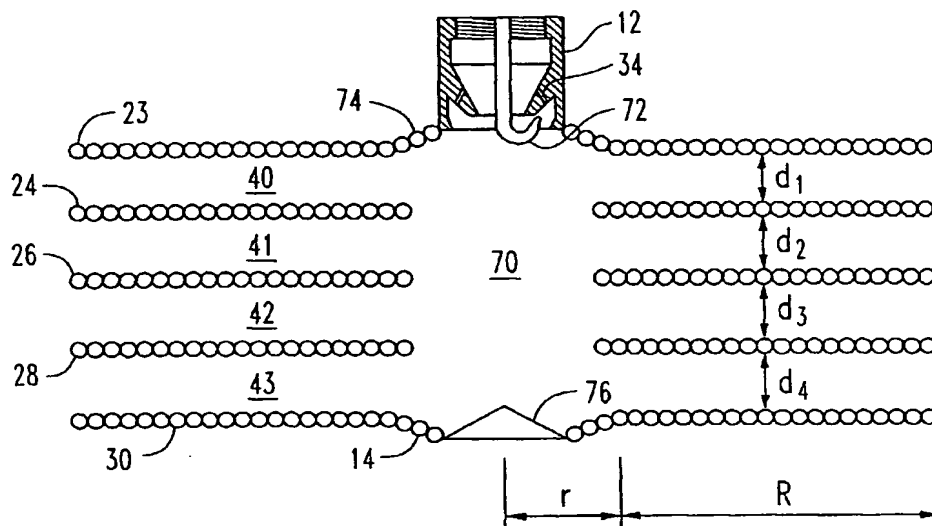
PCT

(10) International Publication Number  
**WO 2004/031651 A3**

- (51) International Patent Classification<sup>7</sup>: **F23C 11/04**, F23M 5/08, F24H 1/43, F23D 14/58
- (21) International Application Number: PCT/CA2003/001514
- (22) International Filing Date: 1 October 2003 (01.10.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: TO2002A000850 1 October 2002 (01.10.2002) IT
- (71) Applicant (for all designated States except US): **POW-ERTECH INDUSTRIES INC.** [CA/CA]; Suite 1700 - 1095 West Pender Street, Vancouver, British Columbia V6E 2M6 (CA).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): **MOVASSAGHI, Mehrzad** [CA/CA]; 2316 West 13th Avenue, Vancouver, British Columbia V6K 2S6 (CA).
- (74) Agent: **VERMETTE & CO.**; Box 40, Granville Square, 230 - 200 Granville Street, Vancouver, British Columbia V6C 1S4 (CA).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:  
— with international search report

[Continued on next page]

(54) Title: MULTIPLE PLATE COMBUSTOR



(57) Abstract: The invention consists of a pulse combustor, comprising two spaced apart outer plates (23,30), the outer plates 5 having flat outer regions, conical regions (74,14) inside of the flat regions and central hubs, where the volume between conical regions of the plates defines a combustion chamber (70). The pulse combustor further comprises a plurality of intermediate plates (24,26,28) located between the outer plates, the plurality of intermediate plates being spaced apart to form tailpipe regions (40, 41,42,43) therebetween and between the outer plates and adjacent ones of the intermediate plates and a burner coupled to one of the hubs, the burner (12) operative to ignite a fuel/air mixture in the combustion chamber. The outer and intermediate plates have spiral coolant passageways therein for conducting cooling fluid to cool expanding gases traveling between the plates through the tailpipe regions. The invention further consists of a burner assembly for use in a combustion chamber.

BEST AVAILABLE COPY



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**(88) Date of publication of the international search report:**  
20 January 2005

## INTERNATIONAL SEARCH REPORT

 International Application No  
 PCT/03/01514

 A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 F23C11/04 F23M5/08 F24H1/43 F23D14/58

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F23C F24H F23D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 035 810 A (MOVASSAGHI MEHRZAD) 14 March 2000 (2000-03-14) figures 1,4,15 column 4, line 10 - line 25 column 6, line 45 - line 52	1-5,8
Y	WO 00/12934 A (CHATO JOHN D ; CLEAN ENERGY COMBUSTION SYSTEM (CA)) 9 March 2000 (2000-03-09) page 4, line 5 - line 10 page 6, line 8 - line 10; figure 2	1-5,8
A	WO 01/53750 A (LOCHINVAR CORP) 26 July 2001 (2001-07-26) figures 6,12 page 20, paragraph 5 - page 21, paragraph 1	6,7
	----- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- \*Z\* document member of the same patent family

Date of the actual completion of the international search

16 November 2004

Date of mailing of the international search report

23. 11. 2004

Name and mailing address of the ISA

 European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax (+31-70) 340-3016

Authorized officer

Mougey, M

## INTERNATIONAL SEARCH REPORT

 International Application No  
 PCT/CA 03/01514

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 000 930 A (KELLY JOHN T ET AL) 14 December 1999 (1999-12-14) column 5, line 31 - column 6, line 31; figure 9	9
A	EP 0 950 853 A (BRAY TECHNOLOGIES PLC) 20 October 1999 (1999-10-20) paragraph '0034!; figure 4	6,7
A	US 4 968 244 A (MOVASSAGHI MEHRZAD) 6 November 1990 (1990-11-06) column 3, line 15 - column 4, line 14; figure 1	1
X	US 6 379 146 B1 (MCDONALD JOHN ET AL) 30 April 2002 (2002-04-30)	10
Y	abstract; figures 1-4 column 5, line 6, paragraph 16	11
Y	PATENT ABSTRACTS OF JAPAN vol. 0071, no. 37 (M-222), 15 June 1983 (1983-06-15) -& JP 58 052908 A (TAKA SEISAKUSHO:KK), 29 March 1983 (1983-03-29) abstract; figure 3	11
X	US 4 492 562 A (MICHEL FREDERICK A) 8 January 1985 (1985-01-08) abstract; figure 3 column 4, line 40 - line 56 column 5, line 23 - line 41	10
X	US 4 702 691 A (OGDEN RICHARD) 27 October 1987 (1987-10-27) column 2, line 45 - line 54 figure 2	10
A	DE 565 470 C (MIAG MUEHLENBAU UND IND AKT GE) 1 December 1932 (1932-12-01) the whole document	11
A	DE 10 41 888 B (DIEPENBROCK & REIGERS N V) 30 October 1958 (1958-10-30) the whole document	11

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA 03/01514

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9

Pulse combustor with plurality of tail pipe regions  
---

2. claims: 10-11

Burner with hollow tube and conic deflector  
---

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No  
PCT/CA 03/01514

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6035810	A	14-03-2000	AT 407293 B AT 910396 A AU 4781296 A WO 9720171 A1 CH 693464 A5 DE 19681671 T0 DK 72598 A GB 2323662 A , B JP 2000500562 T SE 522084 C2 SE 9801925 A	26-02-2001 15-06-2000 19-06-1997 05-06-1997 15-08-2003 15-10-1998 30-06-1998 30-09-1998 18-01-2000 13-01-2004 29-07-1998
WO 0012934	A	09-03-2000	AU 5403599 A WO 0012934 A1 US 6464490 B1	21-03-2000 09-03-2000 15-10-2002
WO 0153750	A	26-07-2001	AU 2777601 A AU 2781001 A WO 0151853 A1 WO 0153750 A1 US 2002092482 A1 US 2003005892 A1	24-07-2001 31-07-2001 19-07-2001 26-07-2001 18-07-2002 09-01-2003
US 6000930	A	14-12-1999	NONE	
EP 0950853	A	20-10-1999	EP 0950853 A2	20-10-1999
US 4968244	A	06-11-1990	CA 1319885 C	06-07-1993
US 6379146	B1	30-04-2002	NONE	
JP 58052908	A	29-03-1983	NONE	
US 4492562	A	08-01-1985	NONE	
US 4702691	A	27-10-1987	CA 1243937 A1 DE 3573463 D1 EP 0158414 A2 JP 1802588 C JP 5000606 B JP 60213715 A	01-11-1988 09-11-1989 16-10-1985 26-11-1993 06-01-1993 26-10-1985
DE 565470	C	01-12-1932	NONE	
DE 1041888	B	30-10-1958	NONE	